

# PATENT ABSTRACTS OF JAPAN

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## (54) RECORDING HEAD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a recording head capable of recording an image of a high quality without generating streak-shaped unevenness and color unevenness by detecting the amount of slipping off of a recording element on a joint between two head members adjacent each other in the direction of an arrangement of the recording elements as to a line head constituted by arranging a plurality of head members in the direction of the arrangement of the recording element.

**SOLUTION:** The recording head comprises a head part which records an image on a recording medium and a sensor part which reads the image recorded on the recording medium by the head part. The head part is constituted by arranging a plurality of head members constituted by arranging the recording elements for recording the image on the recording medium in one direction in the arrangement direction of the recording elements. The sensor part is constituted by arranging the reading elements for reading the image recorded on the recording medium in one direction. The head part and the sensor part are arranged in the position relatively fixed on the same substrate so as to be an integrated head module.

## CLAIMS

### [Claim(s)]

[Claim 1] A head section which records a picture on a recording medium.

A sensor part which reads a picture recorded on said recording medium by this head section.

Are the above the recording head which it had and said head section Arrange more than one and a short length head member which has at least one sequence of a recording element arranged in one way is constituted by arrangement direction of said recording element and said sensor part Two or more read elements for reading a picture recorded on said recording medium are arranged to one way it is constituted said head section and said sensor part are arranged at a position relatively fixed on the same pedestal and it is considered as a unified head module.

[Claim 2] Arrange and have the following and said head section is constituted by one way and two or more short length head members said short length head member It has two or more recording elements for two or more colors for recording a multicolor picture on said recording medium respectively Arrange and said two or more recording elements are constituted by mounting directions of said short length head member for said every recording element for each colors and said sensor part A recording head which arranges two or more read elements for reading a multicolor picture recorded on said recording medium to one way is constituted and is characterized by using said head section and said sensor part as a head module which has been arranged and was united with a position relatively fixed on the same pedestal.

A head section which records a multicolor picture on a recording medium.

A sensor part which reads a multicolor picture recorded on said recording medium by this head section.

[Claim 3] Have the following and said head section is provided with two or more short length head members for each colors for recording a multicolor picture on said recording medium respectively Arrange and said two or more short

length head members are constituted by one way for said every short length head member for each color and said short length head member for each color. Arrange and two or more recording elements corresponding respectively for colors are constituted by mounting directions of said short length head member and said sensor part. A recording head which arranges two or more read elements for reading a multicolor picture recorded on said recording medium to one way is constituted and is characterized by using said head section and said sensor part as a head module which has been arranged and was united with a position relatively fixed on the same pedestal.

A head section which records a multicolor picture on a recording medium.

A sensor part which reads a multicolor picture recorded on said recording medium by this head section.

[Claim 4] Have the following and said head section is provided with two or more short length head members for each color for recording a multicolor picture on said recording medium respectively. Arrange and said two or more short length head members are constituted by one way for said every short length head member for each color and said short length head member for each color. Arrange and two or more recording elements corresponding respectively for colors are constituted by mounting directions of said short length head member and said sensor part. It has two or more read elements for each color for reading a multicolor picture recorded on said recording medium respectively. A recording head which arranges said two or more read elements to one way is constituted for said every read element for each color and is characterized by using said head section and said sensor part as a head module which has been arranged and was united with a position relatively fixed on the same pedestal.

A head section which records a multicolor picture on a recording medium.

A sensor part which reads a multicolor picture recorded on said recording medium by this head section.

[Claim 5] The recording head according to claim 3 or 4 wherein said short length head member for each color shifts a position of a joint between said short length heads and is arranged for said every short length head member for each color.

[Claim 6] Arrange and said sensor part is constituted by arrangement direction of said read element and two or more sensor members said sensor member. Arrange and said a part of two or more read elements are constituted by arrangement direction of said read element and a position of a recording element of both ends of each a head member of said short length. The recording head according to any one of claims 1 to 5 being separated from a read element of both ends of said sensor member of each inside an arrangement direction of a read element of said corresponding sensor member.

[Claim 7] Said sensor part centers on a recording element of both ends of each a head member of said short length. The recording head according to any one of claims 1 to 5 characterized by arranging two or more read elements to a field of said read element corresponding to a field of a recording element for a predetermined element number of both sides of an arrangement direction of said recording element at least.

[Claim 8] The recording head according to claim 7 to which a part for said predetermined element number is characterized by said recording element being above by five elements.

[Claim 9] Each a head member of said short length is arranged in an arrangement direction of said recording element at two or more rows a sequence from which the short length head members which adjoin an arrangement direction of said recording element differ mutually -- and it is arranged so that one or more recording elements may overlap and said sensor part. The recording head according to any one of claims 1 to 5 wherein two or more read elements are arranged to a field of said read element corresponding to a field which the short length head members which adjoin an arrangement direction of said recording element were made to overlap at least.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the recording head which has arranged the head section which records a picture and the sensor part which reads the picture recorded by this head section on the same pedestal and was used as the head module.

[0002]

[Description of the Prior Art] For example what performs image recording is known by moving a recording medium to the transportation direction which intersects perpendicularly the picture for one line (a length of one side) of a recording medium with the arrangement direction of the recording element of a line head using a recordable line head simultaneously as an ink-jet printer relatively. Two or more head members are used and the technique of extending print width is also known for the printer using a line head by arranging these in the composition called stagger structure.

[0003] Here each head member arranges the nozzle (recording element) for breathing out ink and recording a picture on a recording medium to one way and is constituted. In stagger structure two or more head members are arranged alternately (alternation) between two rows in the arrangement direction of the recording element. Two head members which adjoin the arrangement direction of the recording element arranged at a different sequence are arranged so that the pitch between the recording elements of the end may become the same as the pitch between the recording elements

which are not other ends.

[0004]

[Problem(s) to be Solved by the Invention] In order to record a high definition picture without stripe-like density unevenness, etc., in the printer using the line head of such a stagger structure, the alignment accuracy of the joint (break) between head members is important. However, it was dramatically difficult for the recording element to be arranged at the very detailed interval (for example, if it is 1200 dpi about 21-micrometer pitch) to carry out alignment of this correctly and to arrange many head members in stagger structure.

[0005] In the line head constituted by the purpose of this invention canceling the problem based on said conventional technology and arranging two or more head members to the arrangement direction of a recording element, the amount of gaps of the recording element of the joint part between two head members which adjoin the arrangement direction of a recording element is detected and it is in providing the recording head which can record a high definition picture without nonuniformity and stripe-like white and color unevenness.

[0006]

[Means for Solving the Problem] To achieve the above objects, in a recording head which this invention equips with a head section which records a picture on a recording medium and a sensor part which reads a picture recorded on said recording medium by this head section, arrange more than one said head section is constituted by arrangement direction of said recording element and a short length head member which has at least one sequence of a recording element arranged in one way said sensor part, arrange two or more read elements for reading a picture recorded on said recording medium are constituted by one way and said head section and said sensor part, arrange a recording head considering as a head module which has been arranged and was united with a position relatively fixed on the same pedestal is provided.

[0007] This invention is provided with a head section which records a multicolor picture on a recording medium and a sensor part which reads a multicolor picture recorded on said recording medium by this head section and said head section, arrange two or more short length head members are constituted by one way and said short length head member, it has two or more recording elements for two or more colors for recording a multicolor picture on said recording medium, respectively, arrange said two or more recording elements are constituted by mounting directions of said short length head member for said every recording element for each color and said sensor part, arrange two or more read elements for reading a multicolor picture recorded on said recording medium are constituted by one way and said head section and said sensor part, arrange a recording head considering as a head module which has been arranged and was united with a position relatively fixed on the same pedestal is provided.

[0008] This invention is provided with a head section which records a multicolor picture on a recording medium and a sensor part which reads a multicolor picture recorded on said recording medium by this head section and said head section, it has two or more short length head members for each color for recording a multicolor picture on said recording medium, respectively, arrange said two or more short length head members are constituted by one way for said every short length head member for each color and said short length head member for each color, arrange two or more recording elements corresponding respectively for colors are constituted by mounting directions of said short length head member and said sensor part, arrange two or more read elements for reading a multicolor picture recorded on said recording medium are constituted by one way and said head section and said sensor part, arrange a recording head considering as a head module which has been arranged and was united with a position relatively fixed on the same pedestal is provided.

[0009] This invention is provided with a head section which records a multicolor picture on a recording medium and a sensor part which reads a multicolor picture recorded on said recording medium by this head section and said head section, it has two or more short length head members for each color for recording a multicolor picture on said recording medium, respectively, arrange said two or more short length head members are constituted by one way for said every short length head member for each color and said short length head member for each color, arrange two or more recording elements corresponding respectively for colors are constituted by mounting directions of said short length head member and said sensor part, it has two or more read elements for each color for reading a multicolor picture recorded on said recording medium, respectively, for said every read element for each color, said two or more read elements are arranged to one way, it is constituted and a recording head wherein said head section and said sensor part are used as a head module which has been arranged and was united with a position relatively fixed on the same pedestal is provided.

[0010] Hereas for said short length head member for each color, it is preferred to shift a position of a joint between said short length head and to be arranged for said every short length head member for each color.

[0011] Arrange and said sensor part is constituted by arrangement direction of said read element and two or more sensor members said sensor member, an arrangement direction of said read element arranges and constitutes said a part of two or more read elements and for a position of a recording element of both ends of each a head member of said short length is more preferred than a read element of both ends of said sensor member of each that it is separated inside an arrangement direction of a read element of said corresponding sensor member.

[0012] As for said sensor part, it is preferred that two or more read elements are arranged at least to a field of said read element corresponding to a field of a recording element for a predetermined element number of both sides of an arrangement direction of said recording element focusing on a recording element of both ends of each a head member of said short length.

[0013]As for a part for said predetermined element number it is preferred that it is above by five elements of said recording element.

[0014]Each a head member of said short length is arranged in an arrangement direction of said recording element at two or more rows sequence from which the short length head members which adjoin an arrangement direction of said recording element differ mutually -- and it is arranged so that one or more recording elements may overlap said sensor part it is preferred that two or more read elements are arranged to a field of said read element corresponding to a field which the short length head members which adjoin an arrangement direction of said recording element were made to overlap at least.

[0015]

[Embodiment of the Invention]Below based on the preferred embodiment shown in an attached drawing the recording head of this invention is explained in detail.

[0016]Drawing 1 is a top view of one example of the recording head of this invention. The figure shows an example of the recording head of a monochromatic (monochrome) ink-jet printer as a recording head of this invention for example. The recording head 10 shown in the figure is provided with the head section 14 and the sensor part 16 and let these be the head modules 12 which have been arranged and were united with the parallel position on the same pedestal 18. That is both relative physical relationship is being fixed.

[0017]In the recording head 10 first the head section 14 for example it is a recordable line head simultaneously about the picture for one line (a length of one side) of a recording medium in the example of a graphic display it has two or more three short length head chips 22 for the short length head chip (semiconductor chip) 22 which arranged two or more nozzles (recording element) 20 which carry out the regurgitation of the ink in one way and was formed. What is necessary is for there to be no limitation in any way and just to determine it suitably according to the size and the pixel number of a picture resolution etc. to record the number of the short length head chip 22 is two or more.

[0018]These short length head chips 22 are arranged at stagger structure. That is the short length head chip 22 which two or more short length head chips 22 are arranged in the arrangement direction of the recording element 20 at two rows and adjoins the arrangement direction of the recording element 20 is arranged at a mutually different sequence. In the case of the example of a graphic display the three short length head chips 22 are arranged alternately (alternation) between two rows. the row number of the short length head chip 22 -- two rows -- necessity -- although it is enough even if it arranges to three or more rows it is satisfactory in any way. What is necessary is not to limit arrangement of the short length head chip 22 to stagger structure but to arrange it to the arrangement direction of the recording element 20 and just to constitute it.

[0019]In the example of a graphic display short length head chip 22 comrades which adjoin the arrangement direction of the recording element 20 arranged at a different sequence are arranged so that the pitch between the recording elements 20 of the end may become equal to the pitch between the recording elements 20 which are not other ends. Short length head chip 22 comrades which adjoin the arrangement direction of the recording element 20 may be arranged so that the one or more recording elements 20 may overlap. In this case what is necessary is just to use one side of the two overlapped recording elements 20 as a recording element.

[0020]Here the short length head chip 22 which is a head member is explained. Drawing 2 is a sectional view of one example of a short length head chip. The short length head chip 22 shown in the figure was manufactured using semiconductor manufacturing technology and first in the center section in a figure of the semiconductor substrate (silicon substrate) 24. As the ink slot 26 which supplies ink to a nozzle investigates the surface of the semiconductor substrate 24 it is formed so that it may extend perpendicularly to the chart side.

[0021]In order to supply ink to the ink slot 26 two or more ink feed holes 28 punctured so that the rear face and the ink slot 26 of the semiconductor substrate 24 might be opened for free passage are arranged by the extending direction of the ink slot 26 at the predetermined intervals in this ink slot 26. The holding frame 30 is the semiconductor substrate 24 a support member for arranging and to this holding frame 30. The ink slot 32 which supplies the ink supplied to the ink slot 26 formed in the surface side of the semiconductor substrate 24 via the ink feed hole 28 from the ink tank (graphic display abbreviation) is formed.

[0022]Two or more nozzles 34 equip the position symmetrical with the inside of a figure with the nozzle row of two rows arranged by turns at equal intervals along the ink slot 26 across the ink slot 26. Each nozzle (orifice) 34 is hollow circle shape and is formed in the orifice plate 36 which consists of polyimide etc. which were laminated on the semiconductor substrate 24. In 360 dpi (a nozzle/inch) the nozzle 34 is arranged in the pitch of about 71 micrometers per row for example and the nozzle row can realize the resolution of a total of 720 dpi(s) by two rows.

[0023]The heating resistor (graphic display abbreviation) which is the upper part of the semiconductor substrate 24 and controls the regurgitation of the ink from each nozzle 34 in the lower part of a nozzle row is formed. Centering on the ink slot 26 in the surface of the semiconductor substrate 24 outside a nozzle row. The drive circuit 38 which drives each heating resistor is formed and the septum 40 which forms the ink passage which supplies ink to each nozzle 34 from the ink slot 26 is formed between the surface of the semiconductor substrate 24 and the orifice plate 36.

[0024]Ink passes along the ink slot 32 of the holding frame 30 from an ink tank. The ink slot 26 of the surface of the semiconductor substrate 24 is supplied via the ink feed hole 28 punctured by the semiconductor substrate 24 and it is distributed to the nozzle row formed in the both sides of the ink slot 26 via the ink passage formed of the septum 40. And according to image dataturning on and off of each heating resistor is controlled by the drive circuit 38 and the ink of the specified quantity is breathed out from the nozzle 34 corresponding to this.

[0025] If a line head is simultaneously recordable in the picture for one line of a recording medium by using this recording head for example a picture is recordable at high speed all over a recording medium moving a recording medium to a transportation direction. Even if it is a case where a line head cannot record the picture for one line of a recording medium simultaneously a picture is recordable at high speed also to the recording medium of large size by repeating what the sequence for several recording element minutes of a recording head is recorded and the position of a recording head is moved one by one after that and is recorded and performing its moving a recording medium to a transportation direction.

[0026] On the other hand reading of the picture recorded on the recording medium by the head section 14 is possible for the sensor part 16. The catoptric light from the picture recorded on the recording medium illuminated by the illumination light is received and photoelectric conversion of this is carried out by the photo detector (read element) 42 which obtains the image data corresponding to a recorded image is arranged to one way and it is considered as a line sensor. The photo detector 42 is arranged even at the range exceeding the recording element 20 of the both ends of a line head so that reading of the range still wider than the recording element 20 of the both ends of a line head may be possible.

[0027] Here as a line sensor what are conventionally publicly known such as CCD (charge coupled device) and CIS (contact in-line sensor) is available for example. In order to detect correctly the amount of gaps of printing by the recording element 20 of the both ends of each short length head chip 22 i.e. the both ends of a line head and the recording element 20 of the joint part between the short length head chips 22 it is preferred to make the number of the read element 42 per longitudinal one row of arrangement direction unit length of the sensor part 16 into 1.4 or more times of the number of the recording element 20 per longitudinal one row of arrangement direction unit length of a head section. [0028] Since there is naturally a limit also in the length of this line sensor as shown in drawing 3 the sensor part 16 may be divided into the two or more sensor members 44 and these may be arranged and constituted for example in stagger structure in the arrangement direction of the read element 42. At this time completely like the case of the head section 14 sensor member 44 comrades which adjoin the arrangement direction of the read element 42 may be arranged so that the one or more read elements 42 may overlap. In this case what is necessary is just to use one side of the two overlapped read elements 42 as a read element.

[0029] When the sensor part 16 is divided into two or more sensor members 44 the position of the recording element 20 of the both ends of each short length head chip 22 as an arrow shows it needs to be [predetermined element number] separated from the read element 42 of the both ends of each sensor member 44 inside the arrangement direction of the read element 42 of the corresponding sensor member 44 at drawing 3. For example although based also on the contents of the compensation process it is preferred that it is above separated from the recording element 20 by five elements. In other words the range of the recording element 20 for five elements of the both sides of the arrangement direction of the recording element 20 is read in the position of the recording element 20 of the both ends of the short length head chip 22 by the one sensor member 44 without a joint.

[0030] In this example by the read element 42 of the line sensor of the field corresponding to the field of the recording element 20 for five elements of the both sides of the arrangement direction of the recording element 20 containing the recording element 20 of the both ends of the short length head chip 22. The image data of the picture which read the picture printed by the line head and was read by the read element 42 of the line sensor corresponding to these around a total of ten recording elements 20 is used. According to the amount of gaps which detected the amount of gaps of printing by the recording element 20 of the both ends of the short length head chip 22 for example was detected the image data to the recording element near [between the short length head chips 22] the joint is amended.

[0031] By namely the thing for which the position of the joint between the short length head chips 22 and the position of the joint between sensor members are detached (it shifts). If there is a problem in the data which read the portion which is not a joint between the short length head chips 22 with the line sensor it can judge that it is a problem of the joint between sensor members and if there is a problem in the data which read the portion of the joint between the short length head chips 22 with the line sensor contrary to this it can be judged that it is a problem of the joint between the short length head chips 22.

[0032] The sensor part 16 can be used also as a scanner as it is if reading of the picture for one line recorded by the head section 14 is possible like the example of a graphic display. When not using the sensor part 16 as a scanner but using it as mentioned above only for amendment of the amount of gaps it centers on the recording element 20 of the both ends of each short length head chip 22. It is enough for the field of the read element 42 corresponding to the field for the predetermined element number 20 of the both sides of the arrangement direction of the recording element 20 (for example the recording element for five elements) that two or more read elements 42 are just arranged. It is preferred that two or more read elements 42 are arranged to the field of the recording element 20 corresponding to the field which made short length head chip 22 comrades which adjoin the arrangement direction of the recording element 20 overlap the sensor part 16.

[0033] Next according to the flow chart shown in drawing 4 an example of processing in the case of amending the amount of gaps of printing by the recording element 20 of the both ends of the short length head chip 22 is explained. First the head section 14 performs 1st test printing (S1). In this example test printing sets the bearer rate of a recording medium constant and prints the straight line beside one line for example. In order to make the amount of gaps of printing easy to detect it may print every  $n$  ( $n=1$  or more integers) individual of a nozzle to the arrangement direction of the recording element 20.

[0034] Then the picture in which test printing was carried out by the head section 14 is read by the sensor part 16

(S2)and the amount of gaps of the position of the actually recorded picture is detected from the position on which it should be recordedthe assumption position.e.picture(S3). It is that a printing gap occurs from the picture printed by the recording element 20 of the joint part between the short length head chips 22.

[0035]And a printing compensation process is performed based on the detected amount of gaps (S4). Although each publicly known compensation process of this printing compensation process is conventionally availableas mentioned abovea gap of printing of the arrangement direction of the recording element 20 shiftsand changes the image data of several circumferences of the recording element 20 of the both ends of each short length head chip 22 where printing has shifted according to quantityfor example. A gap of printing of the transportation direction of a recording medium can be adjusted by changing printing timing.

[0036]In the line sensor which consists of two or more short length head chips 22the directions of a gap in each short length head chip 22 of every may differ. The direction of a gap is detectable by reading the recorded image by the recording element 20 of the both ends of the short length head chip 22 also in this case. And it checks that 2nd test printing is performed at the last using the image data after amendment (S5)this is similarly read at itand there is no printing gap in the test printing after a compensation process (S6).

[0037]Since the recording head 10 of this invention is used as the head module 12 which has arranged the head section 14 and the sensor part 16 on the same pedestal 18the physical relationship between the head section 14 and the sensor part 16 is being fixed fundamentally. Thereforesince the alignment gap of both at the time of the assembly of the head module 12 is being fixedcompared with the case where the head section 14 and the sensor part 16 have been arranged independentlya printing gap of the recorded image by the head section 14 is correctly detectable.

[0038]Since according to the recording head 10 of this invention the amount of gaps of printing by the recording element 20 of the both ends of each short length head chip 22 can be detected and this can be amendeda high definition picture without nonuniformityand stripe-like white and color unevenness is recordable. According to this inventionsince a gap of printing can be amended even if it is after the assembly of the recording head 10there is an advantage that alignment accuracy high at the time of an assembly is not neededtherefore a product yield is highand the recording head 10 can be manufactured cheaply.

[0039]Performing processing which amends a printing gap at the time of shipment of a product in the recording head 10 of this inventionof courseAlso when fault occurs in one of the short length head chips 22the short length head chip 22 which fault generated can be exchangedand the amount of gaps of printing by the recording element 20 of the both ends of this exchanged short length head chip 22 can be detected and amended. Thereforealso when fault occursit is not necessary to exchange head module 12 alland there are expense concerning repair and an advantage of being cheap.

[0040]This invention is applicable also as a recording head of the ink-jet printer which records a multicolor (color) picture on a recording medium. In this caseas are shown in drawing 5 - drawing 8and the head section 14 may constitute the nozzle row for two or more colors for recording a multicolor picture on a recording medium using the short length head chip 22 formed by unifying or shows it to drawing 9The nozzle row for each colors may constitute using the short length head chip 22 formed independently.

[0041]Herewhen using the short length head chip 22 formed by unifying the nozzle row for each colorsfor example like the recording head 46 of drawing 5the head section 14 arranges two or more short length head chips 22 to one way (single tier)and is constituted. Each short length head chip 22 is provided with two or more recording elements 20 for each colorsrespectivelyevery recording element 20 for each colorsarranges two or more recording elements 20 in a sequence different the mounting directions of the short length head chip 22and mutuallyand is constituted.

[0042]For examplein the recording head 46 of drawing 5each short length head chip 22C (cyanogen)M (magenta)and Y (yellow) -- having two or more recording elements 20 of businessrespectively -- the object for Cand M -- every recording element 20 for business and Ytwo or more recording elements 20 are arranged in a sequence different the mounting directions of the short length head chip 22and mutuallyand it is constituted.

[0043]When there are many color numbersfor example to CMY LC (light cyan)LM (light magenta)When there are all the 6 colors which added LY (light yellow)may unify the nozzle row of all these six colorsmay form the short length head chip 22andOr it may divide into two or more groups like the recording head 48 of drawing 6like the short length head chip 22 formed by unifying the nozzle row of CMYand the short length head chip 22 formed by unifying the nozzle row of LCLMLY.

[0044]Although the sequence of the recording element 20 is arranged in order of CMY from the figure Nakagami side in all the short length head chips 22 in the recording head 46 of drawing 5It is not limited to this butas for the short length head chip 22 of the left end in a figureYCM and -- the 3rd short length head chip 22 from MYC and a left end like the recording head 50 of drawing 7as for a left end to CMY and the 2nd short length head chip 22 like turnThe sequence of the recording element 20 for each colors may be arranged in arbitrary positions.

[0045]Although the recording element 20 is arranged in a different sequence and it comprises the recording heads 46and 50 of drawing 5 - drawing 7 for every colorit is a use as which it is not limited to thisfor examplehigh resolution is not required like [ for color copies ]Like the recording head 54 of drawing 8two or more short length head chips 22 are arranged to a single tierthe head section 14 is constitutedthe recording element 20 for each colors may be arranged to the mounting directions of the short length head chip 22 by turns one by one at a single tierand the short length head chip 22 may be constituted.

[0046]Thussince the relative physical relationship of the sequence of the recording element 20 for each colors contained in each short length head chip 22 is being fixed when using the short length head chip 22 formed by unifying

the nozzle row for each color the advantage that it can be regarded as a thing without a printing gap is between each color.

[0047] On the other hand when the nozzle row for each color uses the short length head chip 22 formed independently like the recording head 54 of drawing 9 the head section 14 it has two or more short length head chips 22 for each color respectively and every short length head chip 22 for each color two or more short length head chips 22 are arranged in a sequence different one way and mutually and it is constituted. The short length head chip 22 for each color arranges two or more recording elements 20 corresponding respectively for colors to the mounting directions of the short length head chip 22 and is constituted.

[0048] When it constitutes from the separate short length head chip 22 for every color it is not indispensable requirements but in order to detect the amount of gaps of printing of each color correctly as shown in drawing 9 it is preferred to make [ which detaches the position of the joint between the short length head chips 22 for every color (it shifts) ] it like.

[0049] When this invention is applied as a recording head of an ink-jet printer in color, [ whether the short length head chip 22 formed by unifying the nozzle row for each color is used and ] When the nozzle row for each color prints in the position which shifted record timing and left each color physically regardless of the difference in whether the short length head chip 22 formed independently is used and reads each color one by one by the sensor part 16 of monochrome. The amount of gaps of printing of the joint part of the short length head chip 22 is detectable.

[0050] For example the recording heads 48 and 52 of drawing 6 and drawing 8 are the examples at the time of using the short length head chip 22 formed by unifying the nozzle row for each color. When the head section 14 is divided into two groups CMY and LCLMLY it may be made to form every one sensor part [ a total of two ] 16 for monochrome like the recording head 48 of drawing 6 corresponding to each of the group of these CMY(s) and LCLMLY(s).

[0051] The recording head 54 of drawing 9 is an example when the nozzle row for each color uses the short length head chip 22 formed independently. When the nozzle row for each color uses the short length head chip 22 formed independently that difference which the joint position of the short length head chip 22 for each color has shifted or not shifted can also detect the amount of gaps of printing of the joint position of the short length head chip 22 for each color which is not related one by one by the sensor part 16 for monochrome.

[0052] Thus even if it is a case where the recording head of this invention is applied to an ink-jet printer in color the sensor part 16 has a thing enough for a functional target with one for monochrome.

[0053] It may be made to detect the amount of gaps of printing of the joint part of the short length head chip 22 like the recording head 46 of drawing 5 using the sensor part 16 for colors which adjusted the absorption wavelength of the read element 42. In this case the sensor part 16 is provided with two or more read elements 42 for each color for reading the multicolor picture recorded on the recording medium respectively every read element 42 for each color arranges two or more read elements 42 in a sequence different one way and mutually and is constituted.

[0054] For example in the recording head 46 of drawing 5 the sensor part 16C (cyanogen)M (magenta) and Y (yellow) -- having two or more read elements 42 of business respectively -- the object for Cand M -- every read element 42 for business and Y two or more read elements 42 are arranged in a sequence different one way and mutually and it is constituted.

[0055] In this case since the alignment accuracy between the line sensors of each color will pose a problem if it arranges independently every read element 42 for each color it is preferred to unify and constitute the read element 42 of all the colors.

[0056] When using the sensor part 16 for colors for example like the recording head 50 of drawing 7 the sensor part 16 may narrow the interval (disposing pitch) of read element 42 comrades and may arrange and constitute the read element 42 for all the colors in a single tier by turns one by one. It is an indispensable condition that the disposing pitch of the read element 42 is narrower than the disposing pitch of the recording element 20 in this case.

[0057] In the recording head 50 of drawing 7 the sensor part 16 sets the disposing pitch of the read element 42 to 1/3 for example compared with the sensor part 16 of the recording head 52 of drawing 8 arranges the object for C the object for M and the read element 42 for Y to a single tier by turns one by one and is constituted.

[0058] Also when this invention is applied as a recording head of an ink-jet printer in color as shown in drawing 3 the sensor part 16 may be divided into the two or more sensor members 44 and these may be arranged and constituted in the arrangement direction of the read element 42.

[0059] Although two CMY and LCLMLY were illustrated as two or more colors (recording element 20) for recording a multicolor picture on a recording medium and CMY was illustrated in the above-mentioned example as two or more colors (read element 42) for reading the multicolor picture recorded on the recording medium it is not limited to this for example R (red) G (green) B (blue) etc. may be added and the combination of other colors may be used and the color number to be used is not limited at all either.

[0060] The head section 14 has the available head structure of a publicly known ink jet in some numbers. Therefore it may be a top shooter type (face ink jet) or may be a side shooter type (edge ink jet). With heating it may be a thermal ink jet which carries out the regurgitation of the ink and a diaphragm (diaphragm) is vibrated using a piezo-electric element electrostatic force etc. and the regurgitation of the ink may be carried out by this power.

[0061] Although the example of a graphic display gave and explained an example of the short length head chip 22 which consists of semiconductor chips as a head member this is not limited to a semiconductor chip either. If it furthermore says this invention will not be what is limited to the recording head for ink-jet printers it is the recording

head 10 using the head section 14 arranged in the arrangement direction of a recording element and can apply to the thing in which reading by the sensor part 16 is possible at the same speed as printing after printing by the head section 14.

[0062]The recording head of this invention is fundamentally above. As mentioned above although the recording head of this invention was explained in detail of course in the range which this invention is not limited to the above-mentioned example and does not deviate from the main point of this invention various improvement and change may be made.

[0063]

[Effect of the Invention]As explained to details above the recording head of this invention arranges the head section constituted by arranging two or more head members to the arrangement direction of a recording element and a sensor part in the position relatively fixed on the same pedestal and uses them as the unified head module. Thereby according to the recording head of this invention the amount of gaps of printing by the recording element of the both ends of a head member can be detected correctly and a high definition picture without stripe-like nonuniformity and white can be recorded. According to this invention since a gap of printing can be amended and alignment accuracy high at the time of an assembly is not needed even if it is after the assembly of a recording head there is an advantage that a product yield is high and a recording head can be manufactured cheaply.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a top view of one example of the recording head of this invention.

[Drawing 2]It is a sectional view of one example of a short length head chip.

[Drawing 3]It is a part plan of one example of the recording head of this invention.

[Drawing 4]It is a flow chart showing each process of a compensation process of one example.

[Drawing 5]It is a top view of another example of the recording head of this invention.

[Drawing 6]It is a top view of another example of the recording head of this invention.

[Drawing 7]It is a top view of another example of the recording head of this invention.

[Drawing 8]It is a top view of another example of the recording head of this invention.

[Drawing 9]It is a top view of another example of the recording head of this invention.

[Description of Notations]

104648505254 recording heads

12 Head module

14 Head section

16 Sensor part

18 Pedestal

20 Nozzle (recording element)

22 Short length head chip (semiconductor chip)

24 Semiconductor substrate

26 and 32 Ink slot

28 Ink feed hole

30 Holding frame

34 Nozzle

36 Orifice plate

38 Drive circuit

40 Septum

42 Photo detector (read element)

44 Sensor member

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